M.O. 284.

The Meteorological Magazine

Vol. 61

October 1926

No. 729

Air Ministry :: Meteorological Office

LONDON : PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.

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A remarkable Stereoscopic Effect produced by motion at right angles to the Direction of View

By G. A. CLARKE

Most meteorological observers are familar with photo-stereograms of clouds, wherein, by the employment of similar cameras at the two ends of a fairly long base line, simultaneous photographs of the clouds can be taken, which, when suitably mounted and viewed in an ordinary stereoscope, give very effective three-dimensional pictures of the arrangement of clouds in space.

It may not, however, be so widely known that a similar stereographic effect may be visually observed in the clouds themselves in certain circumstances, provided that the observer is moving fairly rapidly in a direction at right angles to the direction in which he is looking. Even from the top of a tramcar, moving at about 12 miles an hour, cumulus clouds, if their altitude is fairly low, may be seen to stand out beautifully in stereoscopic relief.

But the effect is much more dramatic when the observer is in a moving train. The writer was travelling on the express train from Aberdeen to London, on the evening of August 10th, the speed of the train being about 45 miles an hour. Between 8 and 8.30 p.m. (B.S.T.) the train was in the neighbourhood of Laurencekirk, proceeding south-westwards along the low-lying valley known as the Strath More. To the north-west there lay the mass of hills, about 1,500 feet high, which forms the eastern

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end of the southern spur of the Grampians, the hills being about 10 miles distant. The afternoon had been cloudy and showery but a partial clearing had taken place, leaving a wide-extended mass of cloud over the mountain area. This cloud mass had a horizontal depth of perhaps 10 miles and culminated on its further side in a fairly well-developed cumulo-nimbus head about 8,000 feet high. In front of the line of hills and about level with their tops lay a long line of low cumuliform cloud (A—B in the diagram, Fig. 1). As the train sped onwards this line of cloud appeared to stand out clearly separated from the

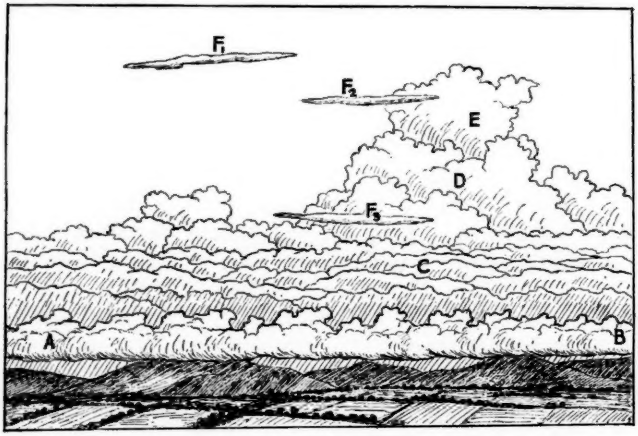

FIG. 1. VIEW OF CLOUD BANK LOOKING NORTHWEST.

general mass behind it. The main cloud-mass appeared to be built up of a series of ridges (C, D, in Fig. 1), one behind the other, rising successively higher upwards to the cumulo-nimbus head (E in Fig. 1). The whole cloud-mass looked exactly like a huge mountain with its slopes and ridges, and it was a comparatively easy matter to deduce, from the three-dimensional view thus presented to the observer, the actual structure of the cloud-mass in a plane at right angles to the view shown in Fig. 1. This structure was approximately as shown in the diagram Fig. 2, wherein the letters indicate the same portions of the cloud as those indicated in Fig. 1. From Fig. 2 it will be seen that the line of cloud A B was detached and in front of the hills while the main cloud-mass rose upwards in a concave slope to the lofty cumulo-nimbus head. The spatial arrangement of the detached fragments of intermediate cloud (F 1, F 2 and F 3), was also clearly apparent.

This stereoscopic appearance was due, of course, to the fact that the velocity of the train was sufficient, when taken in conjunction with the scale of the subject viewed, to give to each

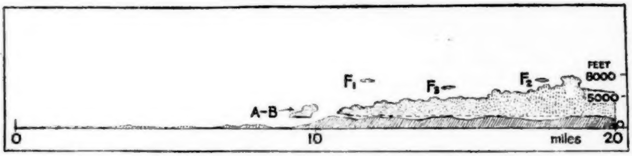

FIG. 2. PROBABLE SECTION OF CLOUD AT RIGHT ANGLES TO VIEW SHOWN IN FIG. 1. (Drawn to scale).

part of the cloud a relative velocity *across* the field of view proportionate to the distance away of such part, and these differing velocities, when viewed all together, produced on the retina the three-dimensional impression just described.

A similar sense of " mass-solidity " is produced by a regiment marching past in " companies."

The Florida Hurricane

Early on Saturday, September 18th, the south-eastern coast of Florida from Miami to Palm Beach was struck by a hurricane, which on the preceding day had ravaged the Turks and Caicos Islands. The visitation appears to have been one of the most severe of the dreaded West Indian hurricanes, but it is not yet possible to give full details of its origin and development. The Daily Weather Charts of the United States Weather Bureau show that a disturbance appeared in about latitude 25° N, longitude 65° W, on the evening of the 9th, and increased to hurricane intensity while it moved very slowly north-westward. It passed west of Bermuda, but at too great a distance to affect the mainland. On the evening of the 11th a shallow disturbance appeared in the Caribbean Sea and moved north-eastward, increasing somewhat in intensity. On the morning of the 14th another disturbance of some depth was reported north-east of St. Kitts and moved directly westward. On the 16th it lay between Porto Rico and Turks Island, moving rapidly west-north-west, and on the 17th it was already attended by hurricane winds near its centre. The forecast for Florida for Friday, September 17th, mentioned, winds " reaching gale force late to-night or Saturday night, especially on the south-east coast." At noon on this day it was realised that the centre was moving directly towards Miami, and warnings were posted. On the morning of the 18th the storm centre lay about 20 miles south of Miami, and hurricane warnings were displayed over the coast

of the southern half of Florida. The centre passed practically over Miami; the official barometer fell to 27·65 in. (936 mb.), and a correspondent of *The Times* reports that two private barometers dropped below 27 inches. The storm then curved to the north-west, striking the coast between Mobile and Pensacola on the morning of the 20th, the wind velocity at the latter place being 100 miles per hour at 8 a.m., when the centre was still some distance from the coast. The hurricane dissipated over eastern Texas on the 22nd.

The hurricane appears to have reached its greatest intensity at Miami and on the coast immediately to the north, which was in the dangerous sector. The first phase lasted for nine hours, and the wind is estimated to have reached a velocity of 130 miles an hour. Then, as the centre passed over, there was a lull, and large numbers of people who did not realise that a second phase was coming ventured out to be caught when the wind rose again to hurricane force in the rear of the centre. The strength of the wind is shown by the nature of the damage done. An 18-storey skyscraper at Miami, recently finished, was twisted so badly that it will have to be demolished. Another tall building was bent over twenty degrees from the vertical. Yachts and small ships were lifted bodily on to the land. At Palm Beach the damage was much less serious, and the loss of life was due chiefly to the collapse of the dam holding back Lake Okeechobee. The first messages gave the loss of life in south-eastern Florida as 1,000 dead and 3,000 injured; later messages reduced the number to 365 dead and 1,100 injured, while 25,000 persons were rendered homeless, and the damage to property is estimated at £33,000,000.

The Florida hurricane, while the most terrible in its consequences, has not been the only disaster of this nature. On September 20th a tornado swept a wide path through the town of Encarnacion in Paraguay, wrecking most of the buildings and resulting in at least 200 deaths, and injuries to another 400 persons. It is stated that trees were uprooted and roofs were carried miles away. About the same time a typhoon in the neighbourhood of Kagoshima, Japan, destroyed 1,200 houses. On September 25th a hurricane traversed the province of San Pablo, Brazil, and the town of Itambe was completely destroyed, over 200 bodies having been recovered. On the 28th a hurricane struck Vera Cruz in Mexico. The wind velocity was estimated at 125 miles an hour; the roofs of houses were blown off and several ships were sunk. The damage was accentuated by torrential rains and a "hurricane wave" at high tide, flooding about 25 square miles of low-lying ground with two to five feet of water. The loss of life however does not seem to have been very great.

It is too soon yet to venture any opinion as to the underlying cause of all these disasters, except to say that they were probably related. The air over the Atlantic Ocean seems to have been in a very disturbed state during the last half of September. It is possible that the small disturbance which moved north-eastward from the Caribbean Sea, while in itself of no importance, caused the main hurricane of the 14th to 21st to follow a more westerly track than it would otherwise have done and thus strike the land instead of keeping to the ocean like its predecessor.

Abnormal Wind Velocities

The wind velocity of 130 miles an hour reported as occurring during the Florida hurricane is not by any means unusual in the hurricane and typhoon regions, though in this country we are fortunately free from such winds. The highest velocity hitherto recorded in the British Isles was one of 110 miles per hour or over at Quilty, on 27th January, 1920, but this is open to doubt.* On 8th March, 1922, a velocity of 108 miles per hour was recorded at Scilly, but the true figure was probably two or three miles less. On the same day the anemometer at Pendennis Castle recorded 103 miles per hour.

There are obvious difficulties in the way of obtaining records of the very high winds sometimes experienced in hurricanes or tornadoes. In the first place an apparatus suitable for the accurate recording of moderate winds may become unreliable when the speed rises to 100 miles an hour or more; secondly, and more serious, the strength of the instruments and their supports is not unlimited. When it is remembered that the pressure exerted by the wind is proportional to the square of the wind velocity, so that a wind of 120 miles an hour is more than nine times as powerful as a wind of gale force (39 miles per hour), it will be seen that a very solidly built and, therefore, very expensive instrument would be required to stand up to hurricane winds.

An experience during the Jamaica hurricane of November, 1912,† is of interest in this connexion. "As the mid-day hurricane came on, the pressure plate (of the Osler anemoneter at Kempshot) was seen to be jerked back continually as far as it could go; the registering part had been arranged to register only 30 lbs. . . . However a violent gust caught the massive vane sideways and broke it in two; the wind then took advantage of this wreckage on top of the wooden structure and hurled the whole out of the ground."

"The evening hurricane was much more violent but lasted a

* *Meteorological Magazine*, 57 (1922), p. 102.

† "A report on the storms and hurricanes in Jamaica, November, 1912." By Maxwell Hall. Report No. 411, Jamaica, 1913.

very short time; at the side of an exposed terrace there were a large number of cubical flower pots placed on the grass . . . full of wet soil . . . they might have exposed as much as six-tenths of a foot of surface to the wind. They weighed on an average 25 lbs. These flower pots were blown . . . here and there; some were upside down, some were far removed from the terrace . . . It required a force of 30 lbs. to move them from their position on the grass . . . so that the wind must have had a greater force than 30 lbs. on the six-tenths of a square foot, or a greater force than 50 lbs. on a square foot, and this would give more than 118 miles per hour." At Black River, Jamaica, during the same hurricane the anemometer had two cups wrenched off at 2 a.m. The wind velocity continued to increase and the velocity was estimated at 150 miles per hour.

In a hurricane at Wilmington, North Carolina, the anemometer registered 138 miles per hour before the cups were carried away, and it was estimated that the greatest velocity reached was 165 miles per hour. Better fortune attended the anemometer at Burrwood, La., at the mouth of the Mississippi during the hurricane of September 29th, 1915, where with practically a free water surface exposure a maximum velocity of 140 miles per hour was recorded. "This is the highest wind velocity ever recorded on the Gulf coast."*

Further north, at Mount Washington, New Hampshire (41° 20′ N, 71° 20′ W), on February 20th, 1884, during a hurricane the anemometer was broken at 2.30 a.m., but it is estimated that the wind velocity exceeded 160 miles per hour during the greater part of the forenoon.

In the hurricane areas of the old world the highest velocity ever recorded autographically appears to be 127 miles per hour, at Hongkong, on 18th August, 1923,† but the damage sustained during some of the great cyclones and typhoons points to much greater speeds which have escaped direct observation, "when the most solid and substantial buildings crack and sway under the impulse of the hurricane; when roofs are carried off and torn to pieces; when heavy sheets of metal whirl through the air like feathers and mighty trees fly great distances as if hurled from a gigantic invisible catapult."‡

The characteristic tornadoes of the United States are associated with wind velocities greater than those of any tropical cyclone. The building which can withstand the direct force of the centre of a fully developed tornado has yet to be constructed. Certainly no anemometer could register the appalling velocity of the wind, and our information has to be obtained by indirect means

* U.S. Weather Bureau. *Monthly Weather Bureau Supplement, No.* 24.
† *Meteorological Magazine* 60 (1925), p. 11.
‡ Algué, J. *The Cyclones of the Far East.* Manila, 1904 p. 205.

similar to the movement of the flower-pots described above. In a group of tornadoes in Iowa and Nebraska, on March 23rd, 1913, soft objects had struck harder objects with such force as to penetrate them, and engineering tests gave velocities of 200 to 400 miles per hour. Trees, beams, horses, cattle and other heavy objects can be whirled up in the air. On one occasion a cart weighing six hundred pounds was carried up into the air, and R. de C. Ward* estimates that velocities may exceed 400 miles per hour. Fortunately the path of destruction is extremely narrow, sometimes only a few yards. Tornadoes are not actually unknown in this country, though they are fortunately rare ; a notable example occurred in South Wales on October 27th, 1913,† in which a sheet of corrugated iron was carried nearly a mile and was found " so firmly wrapped around a fallen telegraph pole that it could not be removed," while " several pieces of slate were found buried to a depth of 1½ inches across the grain of trees."

These notes would not be complete without some reference to the abnormal wind velocities experienced at Adelie Land, " the home of the blizzard," in the Antarctic."‡ On May 15th, 1912, the average velocity for the whole 24 hours was 90 miles per hour, and for the whole month of May 60·7 miles per hour. During individual hours the run of the wind reached or exceeded 100 miles, and the momentary velocity of some of the gusts " doubtless approached two hundred miles per hour." Fuller details will be available when the publication of the scientific report of the expedition is completed.

OFFICIAL NOTICES

Discussions at the Meteorological Office

The series of meetings for the discussion of recent contributions to meteorological literature, especially in foreign and colonial journals, were resumed at South Kensington on Monday, October 11th. The subject for this meeting was a paper by G. M. B. Dobson and D. N. Harrison, entitled *Measurements of the amount of ozone in the earth's atmosphere and its relation to other geophysical conditions.* (London, Proc. R. Soc. A. 110, 1926, pp. 660-93.) The discussion was opened by Mr. J. S. Dines, M.A.

The meetings are held on alternate Mondays at 5 p.m. The subjects for the next two meetings are :

October 25th, 1926. *The measurement of humidity in closed spaces.* Food Investigation Board Special Report No. 8. *Opener*—Mr. E. G. Bilham, B.Sc., D.I.C.

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* " The Climates of the United States," Ginn & Co., 1925, p. 344.

† London Meteorological Office. *Geophysical Memoirs*, No 11.

‡ *The Home of the Blizzard*, by Sir Douglas Mawson, London, Heineman, Ltd. Vol. 1, pp. 111-134.

November 8th, 1926. *Über Temperaturschwankungen in der Stratosphäre und die hochreichenden Antizyklonen.* By R. Mugge (Met. Zs. XLII., 1925, pp. 389-94.) *Opener*—Mr. E. Taylor, M.A., B.Sc.

The dates for subsequent meetings are as follows:—

November 22nd, December 6th, 1926, January 17th and 31st, February 14th and 28th, and March 14th, 1927.

The Director of the Meteorological Office wishes it to be known that visitors are welcomed at these meetings.

Courses of Training for Observers

About two years ago a scheme for obtaining data suitable for the correlation of weather and crops was instituted by the Ministry of Agriculture and Fisheries and the Board of Agriculture for Scotland, acting in co-operation with the Meteorological Office. In connexion with this scheme a course of meteorological instruction was held this year at Kew Observatory from September 27th to 29th. Ten observers from "crop-weather" stations attended the course; two members of the staff of the Ministry of Agriculture and Fisheries were present.

Observers from six stations reporting regularly to the Meteorological Office, but not observing in connexion with the "Crop-weather" scheme, were also present, and continued in attendance at Kew Observatory until October 2nd. These observers had instruction in the following subjects, in addition to those dealt with in the "crop-weather" course:

The routine of observations at health resort stations whose reports are issued daily to the press.

The Weather Map: charting of observations distributed by wireless telegraphy.

Climatology.

The course of instruction at Kew for "crop-weather" observers was followed by a Conference held on September 30th and October 1st at the Meteorological Office in connexion with the same scheme, at which Sir Napier Shaw took the chair. The following papers were read: "The influence of summer rainfall on the fruiting of apples," by Mr. A. H. Lees, of the Agricultural and Horticultural Research Station at Long Ashton; "Meteorological conditions and the growth of barley," by Dr. S. G. Gregory, of the Plant Physiology Research Institute, Imperial College of Science; "The essentials of theory and points of practice in crop-weather work," by Mr. F. L. Engledow, of the Plant Breeding Institute, Cambridge University; "Technique of crop observations," by Mr. T. Eden, of the Rothamsted Experimental Station; "Solar radiation," by Mr. R. Corless, of the Meteorological Office; "The effect of solar radiation on plant growth,"

by Prof. V. H. Blackman, of the Plant Physiology Research Institute, Imperial College of Science; "The value of co-ordination in phenological work," by Mr. J. E. Clark; and "The value of phenological observations in practical agriculture," by Mr. A. Roebuck, of the Midlands Agricultural College.

The Conference was well attended and many speakers took part in the discussions.

Correspondence

To the Editor, *The Meteorological Magazine*

Extremes of Temperature

Returning late from my holiday, I have only just seen your August issue. The author of the interesting article on "Extremes of Temperature" has evidently overlooked the figures published by Dr. and Mrs. Workman in "Ice-bound Heights of the Mustagh" (Constable, 1908). On page 270 is given a list of maxima obtained with the black bulb thermometer on the ten available clear days between July 18th and August 17th, 1903, at heights above 14,000 feet on the Chogo-Lungma Glacier, Karakoram Mountains. On each of these ten days the figure exceeded 183° F., while on July 28th, 204° was reached at a height of 17,322 feet. With a corresponding shade temperature of 56° F. (the screen used is not stated) there is a difference of 148°. No doubt the reflecting power of the snow has a great influence over the temperatures recorded.

HUGH GARDNER.

Oakhurst, Harrow-on-the-Hill. September 23rd, 1926.

Photograph of a Meteor Train

May I call your attention to the article by W. J. Fisher, in the Journal of the R. Astronomical Society of Canada (September, 1926), on the fireballs of November and December, 1925. The author places on record the success of Mr. D. O. Woodbury of Schenectady, New York, in taking a photograph of the "train" left by a meteor on December 29th, 1925. His moral may be quoted :—

> "It is surprising and unfortunate that in these days of unlimited amateur photography only one person had the initiative to get a photograph of this train. Mr. Woodbury's photograph was got under entirely untried conditions as to light and exposure; the writer does not know that a measurable photograph of a meteor train was ever made before. With another as good as this, made anywhere north or south of the train, measurement would have given by far the best determination of a meteor train ever made."

Of course, it would have been still better if each of the alert

photographers had had the initiative to take two or three photographs, then a good determination of the air currents at the height of the "train" would have been possible.

It is worth noting that from the available observations, Fisher concludes that the air currents on this particular occasion were from the west. In 1921, Dr. S. Kahlke published a collection of reports on meteor trails.* Eighteen daylight trails were included; the majority indicated east wind at great heights, but one of the two instances in December gave a west wind and the one in January a north-west wind.

F. J. W. WHIPPLE.

Kew Observatory, Surrey. September 21st, 1926.

Green Flash in London

On Monday, September 13th, from the White Stone Pond, Hampstead, the sun was observed to set over a long building some miles off and at a slightly lower level, giving a very sharp horizon. The sun was a deep orange colour, but its intersection with this artificial horizon was very clear. As the upper rim disappeared the orange colour was replaced—for a fraction of a second only—by a colour which can best be described as a smoky white with a faint tinge of green. The change of colour was abrupt, and the "flash" contained no trace of red.

C. E. P. BROOKS.

NOTES AND QUERIES

Isonotides

Under the heading "Die Isonotiden" Dr. P. Wirth gives in Petermann's Mitteilungen for 1926, p. 145, a description of the distribution of the "rain-factor" over the globe. The rain-factor was devised by R. Lang (Verwitterung und Bodenbildung als Einführung in die Bodenkunde, Stuttgart 1920) as an indication of the state of the ground, and is found by simply dividing the annual rainfall in millimetres by the mean annual temperature in Centigrade degrees. The advantages of the use of such a formula are obvious; desert formations are limited by a much higher annual rainfall in hot areas than in cold, and as Dr. Wirth points out, if the limits are taken simply from the isohyets, the desert areas include regions of permanent inland ice. The chart prepared by the author on the basis of Lang's formula to show the distribution of isonotides over the globe presents a much more natural appearance, the areas with a rain-factor less than 20 being limited to just those regions which are regarded as deserts from the biological point of view.

The formula is however by no means perfect for the purpose.

* *Meteorological Magazine*, London. 56 (1921), p. 293.

With a mean annual temperature of 0° C. the rain-factor becomes infinite, and still nearer the poles it is negative. Moreover, the formula does not differentiate between regions in which the greater part of the rainfall occurs in winter and those of the monsoon type with their rainfall in summer, but it is well known that desert areas are limited by a much lower rainfall in the former than in the latter. To meet these points it would be necessary to devise some formula in which the rain-factors of the individual months are calculated separately and then combined to give the general factor for the year, but there would be many difficulties in such a calculation and the amount of labour involved would be very considerable. Over the greater part of the world the result would probably not differ greatly from that presented by Dr. Wirth, and his chart should prove of great assistance in the application of climatic data to biological researches.

The Fluctuating Rainfall of the Sudan

An article by G. T. Renner, Jr., entitled "A famine zone in Africa: the Sudan," in the *Geographical Review* for October, 1926, raises once again the "vexed question" of desiccation during recent years. The evidence of human geography seems to point to a gradually decreasing rainfall, at least during the present century. There seems to be in progress a gradual southward movement of peoples throughout the Sudan, from the border of grass land and desert to the moist regions of the Guinea coast, and every year the Tuaregs of the desert's edge penetrate a little further south. By 1917 conditions at Sokoto in the north of Nigeria had become so threatening that the British Resident considered abandoning the post. H. Hubert concluded that desiccation has been in progress for at least 60 years, and has been greatly aggravated during the present century, but the late R. Chudeau regarded the variation as cyclical in periods of 20 to 50 years and not progressive. G. T. Renner analyses the rainfall records from a number of stations in the Sudan during the present century and fails to find evidence of a secular change; rather he favours the occurrence of very pronounced irregular variations from year to year which render living exceedingly precarious, with perhaps an eleven year cycle giving heaviest rainfall at sunspot maxima.

During the present century the various European governments have penetrated the Sudan, bringing law and order. The population, formerly kept down by inter-tribal warfare, increases beyond the capacity of the country and as the peoples of the desert edge can only expand southwards, a southward migration is introduced which may be entirely unrelated to climatic changes. Thus the question is still open.

Sunspots and Thunderstorms

Dr. Evald Septer, of the Magnetical and Meteorological Observatory, Irkutsk, calls attention in the *Meteorologische Zeitschrift* for June, 1926, to a remarkable parallelism between the relative number of sunspots and the frequency of thunderstorms in Siberia. The thunderstorm data utilised are the annual averages of the number of days with thunder at 229 stations between latitudes 71° and 43° N, longitudes 59½° and 149½° E, *i.e.*, practically the whole of Siberia. The period covers the 37 years, 1888 to 1924, and includes three maxima and four minima of the eleven year sunspot cycle, all of which are faithfully reproduced on the curve of thunderstorm activity, except that the double sunspot maximum of 1905 and 1907 is represented by a single thunderstorm maximum in 1906. The means of nine years grouped about the three maxima, and of twelve years grouped about the four minima, give :

	Sunspot maxima.	Sunspot minima.
Sunspots	73·0	7·1
Thunderstorms ..	18·4	10·6

The author does not give the correlation coefficient, but from his figures it is found to have the remarkably high value of +·88. The regression equation gives :

No. of Thunderstorms = 10·4 + 0·11 (Relative Sunspot Number).

This is curious ; in each year there appear to be about ten thunderstorms independent of sunspots, and a further number from 0 to 9 associated with sunspots. The manner of their occurrence is also curious, since thunderstorms appear to have a maximum frequency when large groups of spots are directly opposite the earth, but on the side of the sun which is turned away from us, and the author asks the question, at present unanswerable, as to how sunspots in such a position can affect terrestrial weather.

Thunder in Siam

Mr. R. Stanley Breton, B.A., has sent a summary of his observations of the frequency of thunder at Tung Song, Siam (8° 20′ N, 99° 60′ E), about the middle of the Malay Peninsula. The observations cover three to five years between 1921 and 1926, and the average frequency of thunder heard is as follows (days per month) :

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2	2	14	22	25	17	14	17	15	19	15	5

The annual average frequency is 168 days, but in 1923 the total

was 190. The data thus indicate a northward extension of the area of maximum thunder frequency over the East Indies centred at Buitenzorg (Java), which with 322 days a year is so far as is known the most thundery region of the globe.

Winter Thunderstorms

Mr. S. Morris Bower informs us that it is hoped to continue this investigation* during the following winter, and he would be glad to receive reports of thunderstorms in any part of the British Isles, especially in Scotland or Ireland, between October 1st, 1926, and March 31st, 1927. It is to be noted that the period has been extended to include the whole of the six winter months. A note on a postcard of the date and time of the occurrence of thunder or lightning, with the direction in which the lightning was seen, especially at night, will be valuable. Any additional information of the following character will be extremely welcome :—

1. The time when the storm passed overhead or was nearest, with its direction ; and how long it lasted.
2. Severity of the storm ; much or little thunder, or lightning, or both.
3. Whether it was accompanied by rain, hail or snow.
4. Direction and strength of wind ; change of wind (if any).
5. Whether there was a change in temperature during the storm.
6. Any other observation which may be of particular moment.

It is particularly asked that the position of the place of observation should be indicated by mentioning the estimated distance and direction from the nearest town. A note that no thunder or lightning has been observed will be useful. Notes should be sent by postcard or letter to S. Morris Bower, Esq., 10, Langley Terrace, Oakes, Huddersfield.

American Studies of Tropical Meteorology

We have received from Dr. S. S. Visher, of Indiana University, whose book *Climatic Laws* was reviewed in the *Meteorological Magazine* for 1925, p. 22, a number of papers dealing mainly with various points in the meteorology of the tropics, especially in the Pacific Ocean. These papers embody the results of Dr. Visher's investigations into the " Variations in weather due to variations in the frequency, intensity and tracks of storms, and the possible causes and effects of such variations," and are

* See *Meteorological Magazine*, 60 (1925), p. 260.

largely based on field work in the Pacific area during 1921 and 1922. The main results are embodied in a memoir—"Tropical cyclones of the Pacific"—which appeared as *Bulletin* 20 of the Bernice P. Bishop Museum, Honolulu, Hawaii, in 1925. This memoir deals first with the structure, causes, places of origin, frequencies, tracks, &c., of Pacific cyclones, including useful lists of the hurricanes which have visited the various islands or groups during the past century. It has been generally understood that hurricanes are rare within eight or ten degrees of the equator, but on pp. 63-64 a list is given of 68 which have been recorded in latitudes 5° to 8° since 1880 (and mainly during the present century), while one storm is located in latitude 4°; whether north or south is not stated. One would like to have further details in order to make sure that this abnormal occurrence was really a cyclone.

The author is not happy in dealing with the immediate causes of tropical cyclones; for example, on p. 93 we read: "The force of gravity draws air in toward the centre, where a partial vacuum exists. This is the agency which produces the wind." He is on much surer ground in dealing with the effects of tropical cyclones on Pacific Islands, and many of his descriptions bear the stamp of the eye-witness. The "laziness" of tropical islanders, usually attributed to the enervating climate, is here related also to the uncertainty which hurricanes introduce into the reward for toil, and it is suggested that "the occasional destruction by a hurricane of most of the personal property of a village has undoubtedly played at least a small part in the development of communism . . . . . among the natives of the tropics." The harmful effects are due not only to the destructive winds and hurricane waves, but also to the excessive rainfall.

Other points which are dealt with briefly in this memoir are elaborated in special papers. They include "Tropical cyclones and the dispersal of life from island to island in the Pacific" (*American Naturalist*, 59, 1925, p. 70), in which the transporting power of the wind and of abnormal temporary ocean currents is suggested as an explanation of the widespread occurrence of plants and animals; and "Effects of tropical cyclones upon the weather of mid-latitudes" (*Geographical Review*, 15, 1920, p. 107), in which it is suggested that the irregular variations of weather in temperate latitudes result from the irregular occurrence of tropical cyclones. The handicap offered by the irregular rainfall to the development of tropical countries is discussed in the *Geographical Review* for 1925, p. 457.

A Comparison of Hydrological and Meteorological Data

A report has recently been published of the lecture given by

Professor V. I. Pettersson* at the reunion of the International Council for the Exploration of the Sea, in September, 1925, at Copenhagen. The hydrographical statistics of the surface temperature of the sea for the fourteen years 1900 to 1913, are taken from the *Hydrographic Bulletin* of the International Council. It is demonstrated that there exists a fair relation between the mean annual air temperature of oceanic islands, such as Madeira, and the surface temperature of the surrounding ocean, a correlation coefficient of +0·86 being obtained for the values for Madeira and the sea some 35 miles to the north east. By considering the surface temperature of adjacent sea areas, the path of the Gulf Stream and the effect of the encounter with the Labrador Current is studied. The Gulf Stream Drift divides south of Newfoundland into two portions, one going to the north towards Greenland, and the other to the east (south of latitude 40°), to the west coasts of Europe. It is shown that the northerly branch has a seasonal flow, the surplus temperature over the surrounding areas ceasing in January. The Gulf Stream proper shows variations of temperature from one year to another, but the correlation of these variations with the temperature changes of western Europe is nil. Prof. Pettersson estimates the annual variation of the amount of melting ice, by comparing the average departure of the water temperature from the mean temperature in the summer months to the east of Newfoundland. The warmer or colder surface water spreads eastward from this zone of melting ice, as part of the Atlantic drift current to the shores of Europe. It is estimated that this water will arrive 12 or 14 months later. The correlation coefficient between the surface temperature in summer of the area in which the ice melts and the mean annual temperature of the water in the ocean midway between Newfoundland and Ireland in the following year (*i.e.*, 6-8 months later) is found to be +0·45. The variations of this mid-Atlantic temperature are reproduced in the variations of the rainfall of Ireland in the following year, a correlation coefficient of +0·64 being obtained from the data for the years 1900 to 1913. It is shown that the general rainfall values for Ireland, Great Britain, Spain and Sweden are very similar. Thus there is some evidence for suggesting that the rainfall of western Europe is determined by the temperature of the sea on the other side of the Atlantic one or two years earlier.

The author points out that this is a preliminary discussion, and that a larger series of observations and more accurate measurements of the water temperature by automatic recording

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* Etude de la Statistique Hydrographique du Bulletin Atlantique du Conseil International pour l'Exploration de la Mer. By Vilhelm I. Pettersson. *Svenska Hydrog.-Biol. Komm. Skri.* New Series. *No.* 1 *Göteborg* 1926.

instruments are required. The results are both interesting and suggestive, and it is very satisfactory that the hydrological data, in which the name of Professor Otto Pettersson is associated, should be correlated by his son with the meteorological data. This marks a beginning in the carrying out of one part of the programme for the hydrographical and biological work in the northern parts of the Atlantic Ocean, the North Sea, the Baltic and adjoining seas. "The hydrological researches shall have for their object the distinction of the different water-strata, according to their geographical distribution, their depths, temperature, salinity, gas contents, plankton and currents, in order to find the fundamental principles not only for the determination of the external conditions of the useful marine animals, but also for weather forecasts for extended periods in the interest of agriculture."

J.G.

Reviews

The Present Status of Long-Range Weather Forecasting. By R. de C. Ward. Philadelphia, Pa. Proc. Amer. Phil. Soc. XV. 1926.

Professor R. de C. Ward in a paper presented to the American Philosophical Society (*Proceedings*, Vol. XV., 1926) reviews the present status of the problem of forecasting the weather weeks or months in advance. He sets aside as unworthy of serious consideration forecasts based on the behaviour of animals and plants and also the efforts of the almanac makers. He pays little attention to cycles and he also leaves out of consideration the "weather outlook" for a few days or a week, issued from time to time by the British or American meteorological services, on the ground that it is not a forecast. This statement seems rather sweeping; the "further outlook" and the "fine spell" forecast are often of greater value to the general public than the day-to-day forecast, and many meteorologists would support the view that the development of successful "medium-range" forecasting is most likely to result from the extension, both in area and detail, of synoptic charts, with perhaps the addition of regular upper air data. The way in which Professor Ward looks at the problem is briefly this: The "atmospheric machine" which governs our weather does not always "run true," so that "in temperate latitudes abnormal weather is normal." The solution of the problem depends on finding out the cause of these irregularities in the running of the machine, but so far the attempts in this direction have for the most part been little more than experiments, based on hopes and intuitions rather than on sure knowledge.

There are various "schools" of thought; H. H. Clayton looks

to the sun, Sir Gilbert Walker to the state of the machine as shown by conditions in the action centres, F. McEwen to the variations of the great ocean currents, W. Wiese to Arctic Ice. The present writer would suggest that *a priori* all four factors are likely to be of importance, which is already a reason why no very obvious relations should exist between any one of them and the weather of temperate latitudes. Further, each of these causes is in itself complex. Variations of solar radiation act differently under different atmospheric conditions. There are many action centres, interrelated in many diverse ways. Ocean currents are complex entities, subject to outside influences along the whole of their course. We are not likely to overstate the case if we say that the future weather of Great Britain is controlled by twenty-five different and more or less independent factors. It is usual nowadays to investigate these relationships by the method of correlation.

Now if the variations of one element, say pressure, are controlled to an equal extent by the variations of twenty-five factors, all of which are independent of each other, pressure will have a correlation coefficient with each of these factors of about 0·2. An investigator seizes on one of these factors and concludes from theoretical reasoning that it should be of value for forecasting the pressure. He calculates the correlation, obtains a coefficient of 0·2, and unless he is gifted with unusual persistence, he abandons the investigation. His difficulty is that coefficient of 0·2 may readily arise by chance, without indicating any real relationship at all, hence every such coefficient has to be laboriously checked by other methods. But the outlook is not hopeless ; every factor identified and tracked to its lair is so much gained, and in time we shall have laid our hands on the whole twenty-five.

C.E.P.B.

Zum Klima der Turkei. Ergebnisse dreijähriger Beobachtungen 1915-1918, edited by Dr. Ludwig Weickmann. Part II. Die Temperaturverhältnisse der Türkei ; Der Scirocco. By Dr. Peregrin Zistler. 8vo., $9\frac{1}{4} \times 6\frac{1}{4}$, pp. 181, *illus.* Bayerische Landeswetterwarte, München and Geophysikalisches Institut der Universität Leipzig, Leipzig, 1926.

The mind adjusts itself so quickly to actualities, that nowadays the name of Turkey brings to the mind a small patch of land in Asia Minor, and one wonders where in this barren region the author has found the wherewithal to fill nearly 200 pages with information about the temperature and the scirocco. The region dealt with in the first paper, on the temperature conditions, is, however, the old Turkish Empire, and incidentally includes also the south of Russia and the eastern Mediterranean, and the discussion is the most thorough conceivable. Numerous baro-

grams and thermograms are reproduced to illustrate such special points as the onset of cold waves, land and sea breezes, or the types of diurnal variation, while the number of tables of wind frequency would warrant a reference to wind in a sub-title. The tables belonging to this section are extraordinarily complete—mean monthly temperatures for 60 stations, with the amount of precipitation in the year, and the extreme months and the "climatic formula" according to Koppen; mean daily maximum and minimum, mean daily range, mean monthly extremes and range, mean and absolute annual extremes. Charts of isotherms for the Mediterranean region and the Turkish Empire are given for the year, and for January, April, July and October.

The second section, dealing with the scirocco, is equally complete, occupying 65 pages. The usual classification into dry and moist scirocco is adopted, but the author is not content with generalisations; he investigates individual examples by means of daily weather charts and the records of autographic instruments. He concludes that it is essentially a desert wind, and is not limited to the Mediterranean region, but can blow from any great desert. Its immediate cause is a depression passing along the edge of the desert and drawing air from it. The scirocco is initially a hot dry wind, but after crossing a stretch of ocean it may arrive on the opposite shore as a moist wind. It carries much fine sand, but the sandstorms which are sometimes experienced are incidental phenemona due to the upsetting of air in unstable equilibrium.

The scirocco is shallow: in Syria and Palestine it usually entends to a height of 700-900 metres above the ground. Above this is a transition layer to a height of 2,400 to 2,600 metres above the sea, where a layer of winds from west or north-west is met with. The scirocco generally ends suddenly when, with the passing away of the depression, cool moist winds from the sea break in and replace the hot desert winds.

Books Received

Jaarboek, Koninklijk Nederlandsch Meteorologisch Instituut, 1923. A. Meteorologie. B. Aard-magnetisme. (No. 97). Utrecht, 1924.

Ergebnisse Aerologischer Beobachtungen. K. Ned. Meteor. Inst. (No. 106A). Utrecht, 1924.

Falmouth Observatory. Meteorological Notes and Tables for the year 1925. Falmouth, 1926.

Records of the Survey of New Zealand. Vol. II.

Meteorology. Extracts from statistics of New Zealand for the year 1925. Wellington, 1926.

Monthly Rainfall of India for 1924. Calcutta, 1926.

Obituary

John Louis Emil Dreyer, Ph.D., D.Sc.—The death was announced on September 14th, at Oxford, of Dr. J. L. E. Dreyer, the distinguished astronomer, at the age of 74. Dr. Dreyer was born at Copenhagen. He came to Ireland in 1874 to Lord Rosse's Observatory at Birr Castle. While there he began the study of nebulæ, with which his name is so closely connected. In 1882 he was appointed to the charge of Armagh Observatory, which appointment he held until 1916. The observatory was mainly concerned with astronomical work, but at that time it was also one of the seven observatories of the Meteorological Office which had been started in 1868 to obtain continuous records of the meteorological elements, with a view to the discovery of the laws which regulated the changes in the weather. The full programme of observatory work at Armagh, which involved the preparation from the autographic records of hourly readings of pressure, temperature, humidity, wind, rain and sunshine, was discontinued in 1884, from which date Armagh has acted as a second order climatological station. Dr. Dreyer was President of the Royal Astronomical Society from 1923-5.

News in Brief

Tiree.—The need has long been felt for an anemograph station representative of coastal conditions in the west of Scotland, no anemometer having been maintained in the past on the coast between the Orkneys and the west of Ireland. This gap has been filled by the opening last month of an anemograph and telegraphic reporting station at Cornaigmore in Tiree, an island some 25 miles westward of Mull with an open exposure to the Atlantic on the west. The island is for the most part low-lying and flat and thus provides an ideal site for obtaining wind records. Mr. D. O. Maclean, M.C., M.A., Headmaster of the Secondary School at Cornaigmore, has undertaken to act as observer and the first telegraphic report was received in the Forecast Division on the afternoon of September 16th.

The Weather of September, 1926

September opened with severe local thunderstorms, accompanied by heavy rain in south-east England in the early hours of the 1st. Floods occurred in several parts of London, 34 mm. (1·34 in.) of rain were recorded at Greenwich, and 31 mm. (1·22 in.) at Lewisham ; 35 mm. (1·38 in.) fell at Brighton. Letters in the *Times* give for this storm 46 mm. (1·80 in.) between 6.30 and 8 a.m. at East Grinstead, and 54 mm. (2·14 in.) at Oxted, mainly between 7 and 8.45 a.m. These storms were caused by a depression over France. Shallow lows over the Channel caused further heavy rain on the

2nd, including 35 mm. (1·39 in.) at Standon, Herts. The weather continued rather unsettled during the first half of the month. Temperature was generally above normal, except in the north of Scotland; the night temperatures were particularly high, many screen minima being between 60° and 66° F. The sunshine was generally below normal, but good records were obtained in southern England on the 10th. During the third week an anticyclone moved eastward over France from the Azores, southerly winds and bright sunshine causing a short spell of very hot weather. On the 18th many stations recorded maximum temperatures of 80° F. and over, 85° F. was recorded at Camden Square, and the 19th was still hotter; the highest temperatures recorded this year occurred on that day, namely: 85° F. at Kew Observatory, 87° F. at St. James' Park, 88° F. at Greenwich and Kensington Palace, and 91° F. at Camden Square. There was a marked fall of temperature generally on the 20th; nevertheless, values of 80° F. were again registered. The supply of cooler air was brought by northerly winds in the rear of a trough of low pressure, which crossed our islands on the 19-20th causing thunderstorms and heavy rain locally in northern England and southern Scotland. During the last ten days of the month, temperatures were considerably lower, a marked drop occurring on the 25th, when a depression passed across the north of Scotland to the North Sea. The 26th was generally the coldest day, the maximum readings in London being 30°-39° F. lower than on the previous Sunday.

Rainfall was below normal except at some stations in the north and west. Some southern districts had remarkably little rain, the total fall at Calshot being only 6 mm.

Pressure was above normal over Bermuda and over the whole of Europe, with the exception of the northwest coast of Norway, and below normal over Spitsbergen, Iceland, Greenland, Newfoundland and the Azores. Temperature was above normal except along the shores of the Baltic, and rainfall was generally above normal in northern Europe and below normal in the south and central regions, including England. In Sweden the rainfall was on the whole about 10 per cent. below normal though there was an excess of 20 per cent. in the central regions. Owing to a landslide caused by heavy rains many people were killed or injured in a railway accident near Tortosa, Spain, on the 1st. During the early part of the month bad weather continued in Catalonia and round Valencia, and much of the wheat, maize and other crops were destroyed by floods in Toledo. Severe storms swept across the south of France on the 3rd doing much damage. In Portugal the crops are suffering owing to the long hot summer, and the Patriarch of Lisbon has asked that prayers for rain should be said. On the 10th a great landslip

occurred on the Dent du Midi, which blocked up a torrent. This, however, soon broke through and carried down with it masses of rock which obstructed the Rhone Valley, near Bains de Lavey. On the 26th further masses of mud and rock were brought down by the Saint Barthelemy torrent and the river began encroaching on its right bank. The level of the river fell considerably after the 27th and the protective measures could be proceeded with quickly. After nearly two months of beautiful dry weather in Italy stormy weather prevailed there from the 25th to the 30th and considerable damage was done by the heavy rain and hail.

Serious floods were reported from Upper Burma on the 7th, and a typhoon swept across eastern Japan on the 4th causing extensive damage to houses and crops. Renewed floods in the neighbourhood of Hiroshima on the 11th caused many deaths and much damage. Owing to a sudden storm in the Bay of Bengal a country boat capsized on the 17th and 170 people were drowned. Unusually heavy rainfall occurred in the Bombay Presidency during the first half of the month causing damage to the crops. In the Central Provinces and Berar the recent rains are reported to have had a generally beneficial effect.

Fairly general rain fell in the drought-stricken areas of Queensland during the first week of the month.

Unfavourable weather for harvesting has occurred generally in Canada. During the first few days there was much rain, and later snow fell in many parts of Saskatchewan, Alberta and Manitoba. Threshing operations were stopped and the quality of the grain is seriously reduced. Heavy rain occurred in New York on the 6th, and rainstorms in southeastern Kansas brought about flood conditions there on the 12th. On the 18th a disastrous hurricane swept across Florida. For an account of this and other disasters which occurred over a wide region at about the same time, see page 207.

The special message from Brazil states that the rainfall in the northern and central regions was scarce, being 15 mm. and 35 mm. below normal respectively, while the distribution in the southern regions was irregular with an average 45 mm. above normal. Pressure changes were frequent. The cotton, grain and vegetable crops are suffering from lack of rain. At Rio de Janeiro pressure was 3·6 mb. above normal and temperature 4·5° F. above normal.

Rainfall, September, 1926—General Distribution

England and Wales ..	69	per cent. of the average 1881-1915.
Scotland	138	
Ireland	80	
British Isles	88	

Rainfall: September, 1926: England and Wales

CO.	STATION.	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent. of Av.
Lond.	Camden Square	1·52	39	84	*War.*	Birminghm, Edgbaston	·95	24	53
Sur.	Reigate, Hartswood	·76	19	39	*Leics*	Thornton Reservoir	1·52	39	86
Kent.	Tenterden, Ashenden	·60	15	28	,,	Belvoir Castle	1·29	33	69
,,	Folkestone, Boro. San.	·48	12	...	*Rut.*	Ridlington	1·36	35	...
,,	Margate, Cliftonville	·47	12	24	*Linc.*	Boston, Skirbeck	1·85	47	105
,,	Sevenoaks, Speldhurst	1·11	28	...	,,	Lincoln, Sessions House	·98	25	64
Sus.	Patching Farm	·41	10	17	,,	Skegness, Marine Gdns.	·97	25	54
,,	Brighton, Old Steyne	·41	10	20	,,	Louth, Westgate	·65	17	32
,,	Tottingworth Park	·93	24	38	,,	Brigg	·91	23	54
Hants	Ventnor, Roy.Nat.Hos.	·83	21	33	*Notts.*	Worksop, Hodsock	·98	25	65
,,	Fordingbridge, Oaklnds	·95	24	44	*Derby*	Mickleover, Clyde Ho.	1·05	27	59
,,	Ovington Rectory	1·43	36	63	,,	Buxton, Devon. Hos.	3·54	90	109
,,	Sherborne St.JohnRec.	...	..	...	*Ches.*	Runcorn, Weston Pt.	3·69	94	138
Berks	Wellington College	1·34	34	73	,,	Nantwich, Dorfold Hall	2·38	60	...
,,	Newbury, Greenham	·77	20	38	*Lancs*	Manchester, Whit. Pk.	2·88	73	21
Herts.	Benington House	...	..	...	,,	Stonyhurst College	5·44	138	142
Bucks	High Wycombe	1·66	42	88	,,	Southport, Hesketh Pk	4·61	117	168
Oxf.	Oxford, Mag. College	1·34	34	80	,,	Lancaster, Strathspey	4·58	116	...
Nor.	Pitsford, Sedgebrook	1·83	46	102	*Yorks*	Sedbergh, Akay	6·47	164	154
,,	Eye, Northolm	...	..	...	,,	Wath-upon-Dearne	·79	20	50
Beds.	Woburn, Crawley Mill	...	..	...	,,	Bradford, Lister Pk.	1·82	46	88
Cam.	Cambridge, Bot. Gdns.	2·44	62	152	,,	Wetherby, Ribston H.	1·88	48	104
Essex	Chelmsford, CountyLab	·91	23	53	,,	Hull, Pearson Park	·62	16	36
,,	Lexden, Hill House	1·50	38	...	,,	Holme-on-Spalding	·76	19	...
Suff.	Hawkedon Rectory	1·38	35	72	,,	West Witton, Ivy Ho.	2·92	74	...
,,	Haughley House	1·08	27	...	,,	Felixkirk, Mt. St. John	1·83	46	100
Norf.	Beccles, Geldeston	·44	11	23	,,	Pickering, Hungate	1·16	29	...
,,	Norwich, Eaton	...	..	...	,,	Scarborough	1·53	39	85
,,	Blakeney	·78	20	42	,,	Middlesbrough	2·25	57	130
,,	Swaffham	1·15	29	54	,,	Baldersdale, Hury Res.	4·94	125	71
Wilts.	Devizes, Highclere	1·05	27	51	*Durh.*	Ushaw College	2·50	63	124
,,	Bishops Cannings	·99	25	45	*Nor.*	Newcastle, Town Moor.	2·40	61	118
Dor.	Evershot, Melbury Ho.	·47	12	18	,,	Bellingham, Highgreen	3·91	99	...
,,	Creech Grange	·76	19	...	,,	Lilburn Tower Gdns.	3·80	97	...
,,	Shaftesbury, Abbey Ho.	·76	19	31	*Cumb*	Geltsdale	4·99	127	...
Devon	Plymouth, The Hoe	·36	9	14	,,	Carlisle, Scaleby Hall	5·64	143	208
,,	Polapit Tamar	·97	25	35	,,	Seathwaite M.	12·30	312	124
,,	Ashburton, Druid Ho.	1·35	34	43	*Glam.*	Cardiff, Ely P. Stn.	2·02	51	65
,,	Cullompton	1·71	43	76	,,	Treherbert, Tynywaun	3·77	96	...
,,	Sidmouth, Sidmount	1·27	32	55	*Carm*	Carmarthen Friary	1·07	27	31
,,	Filleigh, Castle Hill	3·15	80	...	,,	Llanwrda, Dolaucothy	2·83	72	70
,,	Barnstaple, N.Dev.Ath.	2·53	64	94	*Pemb*	Haverfordwest, School	1·62	41	46
Corn.	Redruth, Trewirgie	1·00	25	32	*Card.*	Gogerddan	3·48	88	96
,,	Penzance, Morrab Gdn.	·79	20	27	,,	Cardigan, County Sch.	1·87	47	...
,,	St. Austell, Trevarna	·95	24	30	*Brec.*	Crickhowell, Talymaes	2·50	64	...
Soms	Chewton Mendip	2·75	70	90	*Rad.*	Birm.W.W.Tyrmynydd	3·43	87	89
,,	Street, Hind Hayes	1·55	39	...	*Mont.*	Lake Vyrnwy	4·09	104	116
Glos.	Clifton College	1·40	35	60	*Denb.*	Llangynhafal	4·00	102	...
,,	Cirencester, Gwynfa	1·01	26	45	*Mer.*	Dolgelly, Bryntirion	3·37	86	79
Here.	Ross, Birchlea	·68	17	35	*Carn.*	Llandudno	2·60	66	114
,,	Ledbury, Underdown	·83	21	43	,,	Snowdon, L. Llydaw 9	9·95	253	...
Salop	Church Stretton	1·84	47	91	*Ang.*	Holyhead, Salt Island	1·54	39	57
,,	Shifnal, Hatton Grange	·94	24	49	,,	Lligwy	2·15	55	...
Staff.	Tean, The Heath Ho.	...	..	...	*Isle of Man*				
Worc.	Ombersley, Holt Lock	·47	12	27		Douglas, Boro' Cem.	...	..	...
,,	Blockley, Upton Wold	1·54	39	73	*Guernsey*				
War.	Farnborough	1·52	39	71		St. Peter P't, Grange Rd	·47	12	18

Rainfall: September, 1926: Scotland and Ireland

CO.	STATION	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	...	..	...	*Suth.*	Loch More, Achfary	8·27	210	144
"	Pt. William, Monreith	2·97	75	...	*Caith*	Wick	2·99	76	120
Kirk.	Carsphairn, Shiel	4·60	117	...	*Ork.*	Pomona, Deerness	4·76	121	164
"	Dumfries, Cargen	4·62	117	157	*Shet.*	Lerwick	4·81	122	160
Roxb	Branxholme	3·36	85	150					
Selk.	Ettrick Manse	4·07	103	...	*Cork*	Caheragh Rectory	1·04	26	...
Berk.	Marchmont House	4·55	116	188	"	Dunmanway Rectory	1·26	32	31
Hadd	North Berwick Res.	4·25	108	204	"	Ballinacurra	·51	13	20
Midl	Edinburgh, Roy. Obs.	4·11	104	218	"	Glanmire, Lota Lo.	·69	18	25
Lan.	Biggar	4·07	103	178	*Kerry*	Valencia Obsy.	...	..	...
"	Leadhills	5·58	142	...	"	Gearahameen	3·30	84	...
Ayr	Kilmarnock, Agric. C.	3·85	98	126	"	Killarney Asylum	2·34	59	65
"	Girvan, Pinmore	4·60	117	120	"	Darrynane Abbey	1·91	49	54
Renf.	Glasgow, Queen's Pk.	2·96	75	107	*Wat.*	Waterford, Brook Lo.	·93	24	34
"	Greenock, Prospect H.	4·84	123	102	*Tip.*	Nenagh, Cas. Lough	2·10	53	75
Bute.	Rothesay, Ardencraig.	4·63	118	114	"	Tipperary	1·67	42	...
"	Dougarie Lodge	3·29	84	...	"	Cashel, Ballinamona	1·14	29	47
Arg.	Ardgour House	9·79	249	...	*Lim.*	Foynes, Coolnanes	2·67	68	93
"	Manse of Glenorchy	6·90	175	...	"	Castleconnell Rec.	1·82	46	...
"	Oban	6·05	154	...	*Clare*	Inagh, Mount Callan	5·85	149	...
"	Poltalloch	4·85	123	106	"	Broadford, Hurdlest'n.	2·65	67	...
"	Inveraray Castle	8·32	211	130	*Wexf*	Newtownbarry	·94	24	...
"	Islay, Eallabus	4·60	117	110	"	Gorey, Courtown Ho.	1·03	26	42
"	Mull, Benmore	15·20	386	...	*Kilk.*	Kilkenny Castle	·79	20	34
Kinr.	Loch Leven Sluice	3·69	94	144	*Wic.*	Rathnew, Clonmannon	1·02	26	...
Perth	Loch Dhu	5·10	130	89	*Carl.*	Hacketstown Rectory	1·58	40	56
"	Balquhidder, Stronvar.	2·94	75	55	*QCo.*	Blandsfort House	1·29	33	47
"	Crieff, Strathearn Hyd.	3·44	87	120	"	Mountmellick	1·60	41	...
"	Blair Castle Gardens	2·64	67	111	*KCo.*	Birr Castle	2·07	53	90
"	Coupar Angus School	4·03	102	203	*Dubl.*	Dublin, FitzWm. Sq.	1·51	38	79
Forf.	Dundee, E. Necropolis	4·04	103	194	"	Balbriggan, Ardgillan	1·76	45	86
"	Pearsie House	2·92	74	...	*Me'th*	Drogheda, Mornington	...	..	...
"	Montrose, Sunnyside	4·39	112	220	"	Kells, Headfort	2·24	57	84
Aber.	Braemar, Bank	2·88	73	115	*W.M*	Mullingar, Belvedere	2·23	57	84
"	Logie Coldstone Sch.	3·40	86	146	*Long*	Castle Forbes Gdns.	2·94	75	102
"	Aberdeen, King's Coll.	4·57	116	206	*Gal.*	Ballynahinch Castle	5·02	128	105
"	Fyvie Castle	4·27	108	...	"	Galway, Grammar Sch.	3·64	92	...
Mor	Gordon Castle	2·59	66	104	*Mayo*	Mallaranny	6·44	164	...
"	Grantown-on-Spey	2·77	70	112	"	Westport House	3·06	78	86
Na	Nairn, Delnies	2·50	63	114	"	Delphi Lodge	8·78	223	...
Inv.	Ben Alder Lodge	...	..	...	*Sligo*	Markree Obsy.	3·66	93	109
"	Kingussie, The Birches	3·10	79	...	*Cav'n*	Belturbet, Cloverhill	2·75	70	111
"	Loch Quoich, Loan	14·10	358	...	*Ferm*	Enniskillen, Portora	2·66	68	...
"	Glenquoich	...	..	...	*Arm.*	Armagh Obsy.	1·98	50	81
"	Inverness, Culduthel R.	2·34	59	...	*Down*	Warrenpoint	1·51	38	...
"	Arisaig, Faire-na-Squir	5·81	148	...	"	Seaforde	1·95	50	71
"	Fort William	8·05	204	127	"	Donaghadee, C. Stn.	1·85	47	77
"	Skye, Dunvegan	7·81	198	...	"	Banbridge, Milltown	1·83	46	74
"	Barra, Castlebay	3·44	87	...	*Antr.*	Belfast, Cavehill Rd.	2·76	70	...
R&C	Alness, Ardross Cas.	2·60	66	89	"	Glenarm Castle	3·71	94	...
"	Ullapool	5·95	151	...	"	Ballymena, Harryville	3·50	89	113
"	Torridon, Bendamph.	7·05	179	101	*Lon.*	Londonderry, Creggan	4·35	110	132
"	Achnashellach	8·93	227	...	*Tyr.*	Donaghmore	2·41	61	...
"	Stornoway	6·62	168	168	"	Omagh, Edenfel	2·43	62	80
Suth.	Lairg	2·98	76	...	*Don.*	Malin Head	4·52	115	172
"	Tongue Manse	3·50	89	111	"	Dunfanaghy	5·02	128	146
"	Melvich School	3·15	80	113	"	Killybegs, Rockmount	6·67	169	145

Climatological Table for the British Empire, April, 1926

STATIONS	PRESSURE: Mean of Day M.S.L. (mb.)	PRESSURE: Diff. from Normal (mb.)	TEMPERATURE: Absolute Max. (°F.)	TEMPERATURE: Absolute Min. (°F.)	TEMPERATURE: Mean Values Max. (°F.)	TEMPERATURE: Mean Values Min. (°F.)	TEMPERATURE: Mean Values ½ max. and min. (°F.)	TEMPERATURE: Mean Values Diff. from Normal (°F.)	TEMPERATURE: Mean Wet Bulb (°F.)	Relative Humidity (%)	Mean Cloud Am'nt (0—10)	PRECIPITATION: Am'nt (mm.)	PRECIPITATION: Diff. from Normal (mm.)	PRECIPITATION: Days	BRIGHT SUNSHINE: Hours per day	BRIGHT SUNSHINE: Percentage of possible
London, Kew Obsy.	1011·8	− 2·6	71	33	57·2	41·9	49·5	+ 2·2	44·3	90	7·5	67	+ 30	16	3·7	26
Gibraltar	1017·8	+ 1·3	73	48	67·4	54·7	61·1	+ 0·1	53·8	79	4·7	25	− 43	10	...	...
Malta	1015·8	+ 1·8	72	50	65·8	56·2	61·0	+ 0·1	57·8	86	5·2	25	+ 3	4	7·4	57
St. Helena	1014·1	+ 4·1	72	60	67·9	61·3	64·6	− 1·2	62·9	90	3·7	51	− 47	19	...	...
Sierra Leone	1011·6	+ 0·8	93	71	90·4	77·0	83·7	+ 1·3	76·9	77	4·7	128	+ 25	6	...	...
Lagos, Nigeria	1009·5	− 0·3	93	73	90·8	77·7	84·3	+ 1·8	79·2	81	7·5	324	+178	13	...	...
Kaduna, Nigeria	1012·0	+ 1·3	98	63	94·8	70·8	82·8	+ 1·3	68·8	47	2·7	101	+ 17	7	...	...
Zomba, Nyasaland	1020·4	+ 1·9	84	55	78·1	60·8	69·5	+ 0·3	...	85	7·6	69	− 23	13	...	...
Salisbury, Rhodesia	1014·7	+ 0·6	83	45	77·1	53·6	65·3	− 0·4	58·9	67	3·3	44	+ 19	3	8·7	74
Cape Town	1018·7	+ 2·4	93	44	74·2	54·7	64·5	+ 1·3	56·7	86	3·5	18	− 31	5	...	...
Johannesburg	1018·4	+ 2·1	79	44	73·6	51·1	62·3	+ 2·5	52·0	55	1·5	5	− 39	4	8·9	78
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	...	...	83	32	75·2	46·9	61·1	+ 0·3	54·4	78	2·0	45	− 9	4	...	...
Calcutta, Alipore Obsy.	1007·8	+ 1·5	100	68	94·6	75·0	84·8	− 0·9	76·1	81	4·9	40	− 8	4*	...	...
Bombay	1010·2	+ 1·4	92	73	88·1	76·5	82·3	− 0·8	73·0	69	3·3	0	− 1	0*	...	...
Madras	1009·8	+ 1·4	102	74	94·8	79·5	87·1	+ 1·8	78·6	71	4·2	3	− 10	1*	...	...
Colombo, Ceylon	1009·9	+ 0·8	93	74	90·5	76·4	83·5	+ 0·9	79·5	72	6·1	64	−135	12	9·2	75
Hongkong	1011·5	− 1·2	83	62	72·9	66·1	69·5	− 1·3	66·6	97	9·2	436	+301	18	2·0	16
Sandakan	...	...	92	75	89·9	76·5	83·2	+ 0·9	77·6	73	...	66	− 37	8	...	...
Sydney	1014·2	− 4·3	85	50	74·3	58·2	66·3	+ 1·6	60·3	67	4·8	80	− 61	11	6·5	58
Melbourne	1014·2	− 5·2	86	41	69·5	53·2	61·3	+ 1·8	55·8	72	6·0	50	− 7	13	4·8	43
Adelaide	1015·2	− 4·8	85	49	74·0	56·0	65·0	+ 1·1	56·3	55	6·7	52	+ 7	12	6·2	55
Perth, W. Australia	1016·0	− 2·5	90	42	72·7	57·3	65·0	− 1·6	59·7	73	7·9	149	+109	19	4·4	34
Coolgardie	1015·1	− 3·4	97	37	76·2	53·8	65·0	− 0·1	56·3	58	3·8	14	− 10	4	...	...
Brisbane	1016·1	− 1·5	90	51	81·4	61·8	71·6	+ 1·3	64·5	70	3·5	60	− 31	10	8·5	74
Hobart, Tasmania	1011·1	− 3·4	75	38	63·8	49·1	56·5	+ 1·4	50·2	68	6·6	50	+ 2	17	5·4	50
Wellington, N.Z.	1020·7	+ 2·6	71	42	64·8	53·6	59·2	+ 2·3	56·2	77	6·5	37	− 62	7	5·4	50
Suva, Fiji	1013·1	+ 2·5	85	68	80·9	72·2	76·5	− 2·2	73·1	85	7·1	257	− 30	21	4·6	39
Apia, Samoa	1011·3	+ 1·4	88	70	85·4	74·8	80·1	+ 1·2	77·2	78	6·1	135	−125	11	5·8	49
Kingston, Jamaica	1014·6	+ 0·5	93	68	88·1	70·8	79·5	+ 1·1	70·0	78	1·8	3	− 28	2	1·9	15
Grenada, W.I.	1015·4	+ 3·0	88	73	85·4	74·4	79·9	+ 1·0	73·0	70	4·7	15	− 43	8	...	...
Toronto	1014·0	− 1·5	72	16	45·3	29·4	37·3	− 4·1	32·1	70	5·1	73	+ 12	14	6·3	47
Winnipeg	1017·0	0·0	80	12	49·8	26·4	38·1	+ 0·3	...	...	4·6	4	− 34	5	7·5	55
St. John, N.B.	1009·2	− 4·4	58	15	41·3	28·0	34·7	− 4·3	31·1	75	5·4	91	+ [illegible]	9	5·9	44
Victoria, B.C.	1015·9	− 1·4	72	40	60·5	46·4	53·5	+ 5·8	48·5	70	6·0	15	− [illegible]	8	[illegible]	61

*For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

Victoria, B.C.	1015·9	− 1·4	72	[illegible]	[illegible]	[illegible]	34·7	− 4·3	31·1	75	5·4	91	+	9	5·9	44
				40	60·5	46·4	53·5	+ 5·8	48·5	70	6·0	15	−	8	5·3	61

*For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.